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Abstract

Theoretical and Experimental Investigations of
Slightly Enriched Zirconium-Hydride Moderated Lattices
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In connection with the development of a heterogeneous zirconium-hydride moderated reactor, several critical and sub-critical measurements on lattices have been performed. These tests were performed in a fixed aluminium lattice by varying the arrangement of rods containing UO_2 or zirconium-hydride with equivalent diameters.

The time-dependent neutron flux behaviour after a neutron pulse was measured. The higher harmonic effects were eliminated through a numerical evaluation method which permitted the determination of the characteristic decay constants, as eigenvalues can also be directly calculated for a given system through theoretical methods which have been developed and employed for this purpose. The reliability of these methods can be illustrated with an example of a $\text{UO}_2\text{-H}_2\text{O}$ experimental core with a large reflector.

Measurements were performed on various zirconium-hydride lattices up to temperatures of 450°C in order to determine temperature dependence of the reactivity. This dependence is of special interest in the case of zirconium-hydride moderation. In this connection several theoretical expressions for the scattering kernel and for the heterogeneous spectrum methods were investigated in order to theoretically describe the experimental results as well as possible.

The critical experiments were performed on a split-table assembly of the Argonne "ZPR" type and were limited a maximum temperature of 200°C . The results of the sub-critical measurements were in essence verified by the critical assembly. In addition measurements with a pile-oscillator, threshold detectors and resonance detectors were made to obtain a very detailed determination of the cell-parameters. These measurements will, in turn, make possible the determination of the temperature dependancy of heterogeneous zirconium-hydride lattices.